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it from the standpoint of the embryologist, it seems to me, fully warrants its discussion in this department.

With the help of Mr. Potts, who has generously given me permission to do so, I propose at an early date to prepare a more extended paper on this organism, with good illustrations. As it is, I must express my great obligations to its discoverer for the free use of many of the facts detailed above.—*John A. Ryder.*

[As this note on Microhydra goes to press, I have met with a paper[1], published in the Proceedings Royal Society, London, Vol. XXXVIII, No. 235, Dec. 11th, 1884, pp. 9–14. According to this account, the supposed hydroid phase of Limnocodium is without tentacles; it was found attached to roots of Pontederia in the tanks of the Royal Botanic Society, Regent's park. The figures given by Bourne of the suspected hydroid phase of the singular fresh-water Medusa known as Limnocodium, are certainly very similar to Microhydra, but the former is larger than the latter and measures from $\frac{1}{60}$th to $\frac{1}{8}$th of an inch long. Colonies of three or four individual zoöids were frequently met with. No true perisarc or cuticula was observed as in Microhydra, but the surface is covered with particles of mud and other *débris*, which becomes glued together by some secretion of the animal, and forms a sort of tubular casing. In internal structure this hydroid stage of Limnocodium differs considerably from Microhydra, however, judging from Bourne's description and figures. Is it possible after all that Microhydra is only the hydriform stage of fresh-water Medusa? If so, it is very probable that it may be allied to Limnocodium, the latter of South American origin, has in all probability a very different life-history from the North American Microhydra, if we may go so far as to assume that the latter has a medusiform adult stage. No lateral budding and dehiscence has been observed to occur in the supposed hydroid phase of Limnocodium, such as takes place in Microhydra, besides the larger zoöids of the former were over six times as long as those of the latter, otherwise there are many striking similarities. Notwithstanding the existence of these resemblances, I think we may assume that if Microhydra should turn out to be only the hydroid stage of a mature medusa-form the latter will be found to be generically distinct from Limnocodium, in which case it might be called Pottsia.—*J. A. R.*]

PHYSIOLOGY.[2]

RECENT BELIEFS CONCERNING CELL-STRUCTURE.[3]—Probably no branch of biology has been so richly developed during the last five years as that which concerns the intimate physical and chemical structure of living cells. In 1665, fifty years after the invention of the microscope, Robert Hooke found that plants were made up of minute "cells and pores." For more than a century after, cells were regarded as tiny vesicles filled with an homogeneous fluid; then, in 1781, Fontana, discovered the cell-nucleus. In 1836, just about the time when the great generalization of the cell doctrine was receiving its first impulse, Valentin described the nucleolus. The work of Carnoy is an interesting account of all that the most refined methods of investigation have been able to discover in the morphology and chemistry of the cell. Carnoy's description is so minute, and goes so much beyond the statements of some of the most trustworthy observers, that the careful reader who has not repeated his demonstrations is apt to view it with suspicion.

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[1] On the Occurrence of a hydroid phase of *Limnocodium sowerbii* Allman and Lankester, by Alfred Gibbs Bourne.

[2] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

[3] *La Biologie Cellulaire*, par le Chanoine J. B. Carnoy, Lierre, 1884.

But, judged by internal evidence, the work has been performed with skill and conscience; the author describes minutely his methods and the nature of the material employed, relying chiefly upon the examination of fresh tissues. The illustrations are all new and uncommonly well executed, but the reader has a right to complain at the complete omission of an index to the contents of the book.

In 1859 Stilling discovered a fibrillar structure in ganglionic cells, and in 1864 Leydig described a similar appearance in the intestinal cells of certain small crustaceans. In 1865 Frommann announced that the fibrillar structure was a general character of living cells and in 1873 Heitzmann arrived at the same conclusion. The existence of fibrils in the cell may be considered established as a general property of living tissue, but authors are by no means agreed as to the distribution and character of the fibrillar structure. Carnoy considers that all cell structure has been gradually differentiated from original formless, homogeneous protoplasm; the typical cell, however, is a very complex apparatus. Taking as an example an epithelium cell from the intestine of the wood-louse, Carnoy describes the cell as composed of hyaline protoplasm inclosed in a membrane, and including a greater or less number of granules. Imbedded in the protoplasm is a nucleus with a membrane of its own.

The cell protoplasm is not homogeneous but is traversed in all directions by a dense reticulum of fibrils, which is attached to the membrane of the nucleus on one hand and to the cell wall on the other. The nucleus exists like a small cell within the substance of the larger. But in the nucleus the fibrillar structure is two-fold in nature. The most evident of these is a convoluted filament of very striking presence and complex internal structure. It stains deeply with coloring reagents, dissolves in dilute alkalies and in strong acids; it forms a gelatinous mass with sodium chloride ten per cent, but dilute acids have no effect upon it; it is not digested by artificial gastric juice, but with iodine, and with Millon's reagent it acts like an albuminoid. This filament appears to have the chemical characters of nuclein; it is identical with the chromatin of Flemming, and is the structure which takes so characteristic a share in the process of cell division. Carnoy insists, in contradiction of Flemming, that the nuclein or chromatin substance is not characteristically in the form of a net-work, but consists of a single complexly convoluted fibril. The filament may occasionally form a true reticulum, but this is an unimportant modification of the typical single thread structure. The nuclein filament may alter and undergo a retrograde metamorphosis with age, and in cases completely disappear; in this process the filament breaks up into irregular pieces which may be gradually absorbed. The presence of the nuclein filament is the only thing which distinguishes the nucleus either chemically or structurally from the rest of the cell. After solution of the nuclein or chromatin filament, a second structure is discovered in the nucleus, namely, a fine reticulum which has all the characters of that previously described as existing in the extra-nuclear protoplasm. In his later work, Flemming is said also to have admitted the existence of this intra-nuclear net-work. The wall of the nucleus is imperforate and, in contradistinction to Klein, there is no direct union between the nuclear and extra-nuclear reticulum of fibrils. The reticula are much more resistant towards solvents than are most albuminous substances. The fibrils of the nucleus are insoluble in water, alcohol and ether; in sodium chloride ten per cent, in dilute acids and, at a low temperature, in strong acids and alkalies; the reticulum is not digested by artificial gastric juice. The formless protoplasm in the meshes of the net-work contains much water holding albuminoids in solution and granules of various kinds in suspension. The author believes that all the reticular substance of the cell is especially endowed with the properties of irritability and contractility, while the more fluid protoplasm within its meshes is the seat of the general chemical changes of the cell.

The cell-wall is differentiated from the protoplasm by a series of very gradual changes. The outermost layer of protoplasm takes on modified physiological characters. While still living and contractile it becomes much the most resistant part of the cell toward reagents, even more so than the substance of the reticulum itself. The membrane, like the cell matter, is made up of a close reticulum of fibrils whose interstices are filled by a more fluid substance. By a series of insensible gradations the protoplasmic membrane may be differentiated into a rigid, inert cell envelope. The various markings which are so striking a feature in the walls of many cells, both animal and vegetable, probably owe their foundation to this complicated structure of the original living cell-membrane.

Nucleoli of two distinct kinds have been confused together by authors. The first of these consists merely of detached pieces of the nuclein or chromatin filament. The second kind of nucleolus is only a nucleus in miniature, and is quite independent (Strasburger to the contrary) of the chromatin filament. This nucleolus is a reserve fund for the use of the nuclear protoplasm and true nucleoli disappear during the process of cell-division. The membranes of cell and of nucleus are identical in their general characters.

The peculiar parallel streaks which are found connecting the two rosettes of chromatin substance after these have separated during cell-division, Carnoy declares to be formed by the fibrils of the reticula found in the membrane and protoplasm of the mother nucleus, the parallelism being caused when the mother nucleus pulls itself apart. After complete formation of the daughter nuclei, the parallel fibrils become again transformed into the protoplasmic reticulum of the new cells. A rather full list of references to work on this subject may be obtained by consulting Carnoy, *op. cit.;* Flemming, Virchow's Archiv, 1879, Bd. 77, p. 1; Arnold, same volume, p. 181. The English reader may find a good general review of the subject in *Quart. Journ. Mic. Sci.*, 1882, p. 35.

THE PHYSIOLOGICAL CHEMISTRY OF THE KIDNEY.—It has been made almost certain by the various labors of Ludwig, of Heidenhain and of Nussbaum, that the kidney tubules where lined by cells containing considerable protoplasm are differentiated in their function from the thin walled Malpighian capsules at the extremities of the tubules. The commonly received opinion is that the wall of the capsule serves simply as a diffusion and filtration membrane through which pass water and inorganic salts which make up the bulk of the urine; while the large-bodied cells of the tubules, particularly of the convoluted portions, may be looked on as true secretory mechanisms which have the power of actively selecting certain substances, as urea and urates, from the lymph, and probably also of manufacturing specific products. Dr. Dreser comes forward to extend the evidences for a differentiation of function between the two parts of the secretory mechanism of the kidney. Dreser, experimenting on frogs, thinks he has shown that the fluid passed through the capsules of the kidney is *alkaline*, while that secreted by the convoluted portions of the tubules is *acid* in reaction.

The results of the work depended upon the peculiar behavior of "acid fuchsin" toward alkalies and acids respectively; the former render it colorless, while the latter restore its red tint. A five per cent to ten per cent solution of acid fuchsin is injected into the lymph sac of a frog and in half an hour the urine, drawn by a catheter, is distinctly red. If sufficient material be injected the red tint of the fluid becomes less deep, but still is immediately intensified by the addition of acid; this indicates that the kidney still secretes the injected fuchsin, but that its power of forming acid is diminished, probably due to fatigue of the secretory protoplasm. The kidney, examined microscopically early in the experiment, offers nothing peculiar in its appearance, all parts are equally colorless; but when fuchsin has been continuously eliminated during some hours the cells of the convoluted portions of the tubules are found stained deeply red, while the capsules are quite without color.

Heidenhain found in his researches on the elimination of indigo-carmine by the kidney that the nuclei of the cells were always deeply stained; but Dreser could, in his experiments, scarcely ever make out a reddening of the nuclei, though the cells were often so deeply stained that their outlines were indistinguishable. The author's lengthy discussion of the chemical-physiological bearings of his results cannot be given here.—*Zeitsch. f. Biol., Bd. xxi, p. 41.*

A VALUABLE SERIES OF PHYSIOLOGICAL JOURNALS.—The library of the University of Michigan has recently been enriched by the addition of a series of German journals of anatomy and physiology which represents the current progress of those sciences almost continuously from 1796 up to the present time. Reil's Archiv f. d. Physiologie was first published in 1796 and continued until 1815. Meckel's Archiv f. d. Physiologie extended from 1815 to 1823, and was succeeded in 1826 by Meckel's Archiv f. Anat. u. Physiol., which was given up in 1832. Müller's Archiv f. Anat. Physiol. u. Wiss. Med., continued from 1834 till 1858, and was succeeded by Reichert and DuBois Reymond's Archiv f. Anat. Physiol. u. Wiss. Med., which was published from 1859 till 1876. This in turn was succeeded in 1876 by the Archiv f. Anat. u. Physiol., at present edited by Professor DuBois Reymond. No physiologist can contemplate this splendid series of works without thoughtful and affectionate interest, for it forms the log-book of the progress of modern physiology. Reil, in the opening pages of his first volume written in 1795, strikes the key-note of modern physiological research, and some of his words seem like a prophecy which the history of ninety years has fulfilled. Says he, "It is indeed remarkable that physiology, if I exclude anatomy from it, has made relatively less progress than almost any other science and is, for the most part, but a waste of unfounded or senseless hypotheses. * * * * We seek the explanation of the phenomena of animal life in a supersensuous substratum, in a soul, in an universal spirit of nature, in a principle of vitality, which we picture as something uncorporeal, and we are thereby either hampered in our investigation or actually led astray. * * * * We must no longer regard the animal body as something of wholly mysterious and unthinkable properties, but, if we except the mental side, as a merely physical object included in the category of natural bodies; an object which is subject to the same laws of nature as are wood and iron, but which, nevertheless, like wood and iron, has its own peculiar qualities."

THE HISTOLOGY OF STRIPED MUSCLE-FIBER.—Mr. B. Melland makes an important contribution to the literature treating of the structure of muscular tissue. His view is a confirmation and extension of that long since announced by Schäfer (Quain's Anatomy, 2d vol.). The following is a summary of the author's main results: "There is an intra-cellular net-work present in the muscle-fiber of Dytiscus, the bee, frog, lobster, crayfish and rat, which may be most clearly demonstrated by certain methods of gold staining. The net-work alone is stained by the reduced gold, and, owing to this differentiation, is plainly visible with comparatively low powers. This net-work may be demonstrated, though not so completely, in the living fiber, and in acetic and osmic acid preparations. Crossing the fiber transversely, united to the sarcolemma, and more or less separating the muscle-fiber into compartments, are net-work partitions—the transverse net-works. Running longitudinally down each compartment, and joining the dots at the intersections of the fibers of the transverse net-work, are a series of fine rods. This net-work consists of an isotropous material, and is more highly refractile than the rest of the muscle substance, which is anisotropous. This net-work serves to explain the transverse striation and other complicated appearances presented by the muscle-fiber, and brings into harmony many of the conflicting statements of histologists on this subject."—*Quart. Journ. Mic. Sci., 1885, p. 371.*

PSYCHOLOGY.

INTELLIGENCE OF THE ELEPHANT.—In his interesting Two Years in the Jungle, Mr. Hornaday, gives us these impressions of the intelligence of the elephant:

The elephant is the most patient and obedient of all animals, and by far the most intelligent. He has more ability to reason from cause to effect than most other animals of docile temperament, and he is, beyond all question, the most capable of being taught, and the most willing to obey after he has been taught. To me it is a matter of surprise that Mr. Sanderson, who has, I presume, more personal knowledge of the animal, both tame and wild, than any European living, should place so low an estimate upon his mind. He declares that "its sagacity is of a very mediocre description," and also that "its reasoning faculties are far below those of the dog, and possibly other animals."

From this view, which I think is due to the fact that "familiarity breeds contempt," I differ very widely. My acquaintance with tame elephants has created in my mind a respect for their